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Human Electricity. For forty years, with but slight intermission, he had one of Alexander Bain's electric clocks at work. As a meteorologist he was most painstaking and diligent in taking observations. As a boy he had knocked about a good deal off the Hampshire coast, and the knowledge then acquired of tides, wind, currents, and nautical matters never forsook him. His fifty-three years' residence in one house at Black Rock gave him a very accurate knowledge of the meteorology of Brighton.

This is not the place in which to record his inner life. We may only say that he was a most charitable man, and as years increased the love of giving increased. He spent a busy, practical, and useful life, with only a brief period of rest. He laid down to die after he had commenced his 90th year.

He was elected a Fellow of this Society, 1835, January 9.

James Wigglesworth was born in 1825, and during the whole of a very busy life had but one recreation, viz. the study of Astronomy. He was an exceedingly careful observer, and had it not been that his health gave way almost immediately after the erection of his large observatory at Scarborough, much good work would have been done there with the assistance of Mr. Lohse, who was engaged by him as observer. Mr. Wigglesworth was on very intimate terms with the late Thomas Cooke, and in 1853 purchased the first 6-inch refractor made by him. This instrument was in use by Mr. Wigglesworth for thirty years. In 1879 Mr. Wigglesworth purchased the Buckingham Works of Messrs. Cooke at York, and that old firm of eminent opticians is now carried on by his son in connection with Messrs. F. and T. Cooke. Mr. Wigglesworth was elected a Fellow of this Society 1885, January 9.

(*Omitted Obituary* for 1883.)

Karl Knorre, the son of Christoph Knorre, Extraordinary Professor of Astronomy in the University of Dorpat, was born in that town $\frac{\text{28 March}}{\text{9 April}}$, 1801. In his tenth year he lost his father, whose widow, being left with three children, and in poor circumstances, then went to live with her brother, Karl Senff, who was also a professor in the Dorpat University.

Knorre had from childhood shown great mathematical talent, which rapidly developed under the encouraging instruction of his father into a striking inclination for the exact sciences. This gave him the power even during the lifetime of his father (while yet only eight years old) to perform some minor services in the teaching of mathematics, and after his father's death the boy assisted his mother with the small income derived from the lessons which he gave.

In 1812 Knorre entered the Dorpat Gymnasium, and five years later proceeded to the University, where, in accordance with the wish of his uncle, he commenced the study of theology.

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Feeling no inclination for this, however, he soon discontinued it, and gave himself with zeal and pleasure to the private study of mathematics and astronomy, which sciences he had never studied at the University. During the short time that he attended the theological faculty he devoted his nights to astronomical observations in the Observatory. This private study, without any other help than that of his books, says much for his extraordinary talent. At this time the survey of Lirland was undertaken by W. Struve, who selected Knorre as his assistant, thereby giving a new impetus to his studies.

In 1812, on the recommendation of Struve, and by the desire of Admiral Greig, Knorre was appointed Professor of Practical Astronomy at the School of Navigation in Nikolajew. This appointment opened the fairest prospects for the future, as it gave him the direction of an observatory, which was to be built under his superintendence.

The Black Sea fleet was then under the command of Admiral Greig, and to this intelligent and generous man many useful institutions owe their origin, among which the Observatory of Nikolajew takes an honourable place. The tasks set before it were: (1) To satisfy the demands and needs of the marine; (2) to form a centre for the hydrographic operations about to be commenced; (3) to engage in purely scientific work. Knorre devoted himself with zeal and ability to perform these duties allotted to his observatory, and won for it by his labours a worthy position among the observatories of Europe. In 1824, four years after Knorre's entrance upon his duties, Admiral Greig procured for him the means for a two years' scientific journey abroad. Knorre visited the principal observatories and manufactories of astronomical instruments in Germany, England, and France, and became personally acquainted with the heroes of his science. In the summer of 1827 he arrived at Munich at the same time as Bessel, who entrusted to him a portion of the computations for his "Tabulæ Regiomontanæ," which was published at Königsberg in 1830.

He returned to Nikolajew in the autumn of 1827, and entered on his duties in his new, almost completed observatory, which he continued to direct for fifty-one years with uninterrupted devotion and zeal. He was compelled to do everything himself, as he never had an assistant or any other help in his work. At the same time he gave lectures on practical astronomy at the School of Navigation until 1865, when, in consequence of the non-existence of the Black Sea fleet, the institution was closed. Thus all the navigating officers were his former pupils, and not a few of them became able specialists under his tuition. Under his direction and with his co-operation were carried on during thirty years the detailed surveys of the coasts of the Black Sea and the Seas of Azof and Marmora, as well as the straits connecting them and the rivers opening into them. Knorre commenced these surveys personally in the summer of

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1822. Later on he gave advice both as to the observations and the carrying out of the work; he determined the formulæ for the computations of the observations, submitted them to strict proof, and calculated many himself. His hydrographic work, however, was not confined to these labours. Admiral Greig, who knew how to value and reward his many-sided ability and mathematical knowledge, employed him to solve and work out various problems relating to shipbuilding, which, though by no means belonging to his branch of study, his comprehensive knowledge enabled him completely to master.

The following is a list of Knorre's printed works:—

1. Der Ort des Polarsterns für jeden Tag der Jahre 1823–30. (Nikolajew, 1824.)
2. Der Ort des Sterns δ *Ursæ minoris* für jeden Tag der Jahre 1823–30. (Nikolajew, 1824.)
3. Sheet 5 of the *Berliner Akademische Sternkarten*, with the Catalogue of Stars. (Berlin, 1835.)

(*In Russian.*)

4. Solution of Triangles. (Nikolajew, 1832.) [In this work plane trigonometry is treated as a special case of spherical. As the sides of a spherical triangle become infinitely small, the formulæ are transformed into those of plane triangles.]
5. Researches on the "Progressika" (Nikolajew 1838). [The "Progressika" is the curve $(n-1)xy^2+ay^2=b^2nx$. It is used in calculations connected with shipbuilding.]
6. Instructions for the Determination of the Altitude of the Pole, Clock Correction, and Instrumental Errors by Gauss's Method. (Nikolajew, 1832.)
7. On the Star Maps, the preparation of which has been undertaken by the Berlin Academy. (Nikolajew, 1836.)
8. Treatise on the work of Prof. Sawitsch, "Anwendung der praktischen Astronomie zu geographischer Ortsbestimmung." (St. Petersburg, 1845.) [For this work Knorre received the Gold Medal of the St. Petersburg Academy.]
9. Exposition of Bessel's Method of Clearing Lunar Distances. (Nikolajew, 1837.)
10. Determination of the Error of Collimation of the Mirror in Magnetic Theodolites. (Nikolajew, 1869.)
11. Lectures on Practical Astronomy, given in the School of Navigation of the Black Sea Fleet.

Besides these works, he was the author of many contributions to Schumacher's *Astronomische Nachrichten*, and Demidoff's "Voyage dans la Russie Méridionale et la Crimée"; also of

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many years' magnetical and meteorological observations in Kupper's "Sammlungen," and of many smaller papers and translations. He furnished yearly, without remuneration, the astronomical part of the almanacs published in Odessa and Tiflis, besides lesser contributions to these works. There also deserves to be mentioned his improvement in sextants, consisting in the placing of a level upon the alhidade. By this arrangement the identification of a star observed in a mercurial horizon with the image reflected from the mirror is considerably facilitated (*Astron. Nachr.*, Band 7, p. 262).

The most important work of Knorre's was sheet 5 of the *Berliner Akademische Sternkarten.* It was chiefly the accuracy and completeness of this sheet that inspired a zealous lover of astronomy, the late Secretary Hencke, of Driesen, with the idea that the continued comparison of this map with the heavens must lead to the discovery of new planets. Hencke's perseverance was rewarded on December 8, 1845, by the discovery of *Astræa.* This brilliant success made a great impression on the scientific world, and at once engaged many young astronomers in similar researches. On July 1, 1847, Hencke succeeded in discovering another planet, *Hebe,* and this was followed, on August 13 of the same year, by the discovery of *Iris* by Mr. Hind. Since then so many minor planets have been found, that the number of discoveries yet to be made can no longer be reckoned. When astronomical history records these discoveries it will be acknowledged that Knorre's map gave the first impulse to this enrichment of our knowledge of the Solar System, so far surpassing all expectations.

Thus he lived and worked during half a century, in a great measure cut off from cultivated scientific society, and depending almost entirely on himself and his books. He often felt this keenly, although otherwise contented with his respected and independent position.

After the conclusion of the Crimean war Nikolajew, which, on account of its admiralty and observatory, as well as being the seat of administration, had the charge of attending to the wants of the Black Sea fleet, lost its special function. The observatory also obviously lost the object of its existence, and its high position was reduced by this sudden change. The blow which followed the Treaty of Paris in 1856 seemed the more crushing, in that Greig's creations in Nikolajew had been so promising and important for the future, and so significant in their successes. Knorre was filled with sorrow and anxiety; his hopes for the future of his observatory were destroyed; yet he was by no means disheartened, and did not relax his energies. With continued ardour and zeal he carried on his usual duties, besides his scientific labours, though in the latter he was greatly hindered by the unfavourable circumstances resulting from the catastrophe already mentioned. The observatory, which had been an attribute of the marine, suffered the loss of its position

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and significance, and sank into the background. It was now little regarded, and was deprived of the means for performing various tasks, and particularly of the means for purchasing new astronomical instruments which were necessary to Knorre for his observations and studies. As a scientific institution it was only the European fame and highly-esteemed personality of its director that preserved for the observatory its honourable position and continued existence. In order to duly appreciate its achievements these unfavourable circumstances must always be taken into account. In this manner, and in the midst of these discouraging surroundings, Knorre performed his duties in the observatory which had become so dear to him for fifteen years longer, till the summer of 1871. A man of seventy, he now longed for repose, and in August 1871 he resigned his position, retiring from the service with the rank of a "Geheimrath." In September he left with his family for Berlin, where he spent the evening of his life in rest and retirement. After a period of twelve years, which he passed in happiness and contentment in the midst of his family, he passed peacefully away on September 10, 1883, in the 83rd year of his life.

From his great talents and wide knowledge, as well in the exact as in other sciences, Knorre was an authority not only in naval circles and in those of his scientific friends, but also among the intelligent inhabitants of Nikolajew, who highly valued his opinion and advice, which were given with kindliness and courtesy to all who came to him for instruction and information. Through the nobility of his character and his generous views he won universal respect and sympathy from all who knew him.

Professor Knorre was elected an Associate of this Society 1848, May 12.